

FLINT BRIDGE
National Covered Bridges Recording Project
Spanning First Branch White River, Bicknell Hill Road
Tunbridge vicinity
Orange County
Vermont

HAER VT-29
VT-29

PHOTOGRAPHS

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WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD

National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240-0001

HISTORIC AMERICAN ENGINEERING RECORD

FLINT BRIDGE

HAER No. VT-29

LOCATION: Spanning First Branch White River, Bicknell Hill Road, Tunbridge
Vicinity, Orange County, Vermont
UTM: 18.703935.4869374, Chelsea, VT Quad.

DATE OF
CONSTRUCTION: 1874

STRUCTURAL
TYPE: Queenpost truss

DESIGNER/
BUILDER: Ira Mudgett

PRESENT OWNER: Town of Tunbridge

PREVIOUS AND
PRESENT USE: Public road bridge since its construction

SIGNIFICANCE: Flint Bridge is a well-built example of the queenpost truss, an important style of timber framing with a history going back to the Middle Ages. The bridge is also significant because of the sympathetic restoration work done in 1969 by Milton Graton who mostly used original materials and techniques.

HISTORIAN: Joseph D. Conwill, Editor, *Covered Bridge Topics*, July 2002

PROJECT
INFORMATION: The National Covered Bridges Recording Project is part of the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial works in the United States. HAER is administered by the Historic American Buildings Survey/Historic American Engineering Record, a division of the National Park Service, U.S. Department of the Interior. The Federal Highway Administration funded the project.

Chronology

1570	Andrea Palladio describes the queenpost truss
1761	Tunbridge is chartered
pre-1804	First bridge on Flint Bridge site
1874	The present bridge is built
1890s	Main road relocated to west side of river
1969	Restoration by Milton S. Graton

Tunbridge, A Covered Bridge Capital

Tunbridge is one of Vermont's premier covered bridge towns, with five of them within its boundaries. Only Montgomery, with six, has more. All but one covered bridge in Tunbridge use a multiple-kingpost truss with closely spaced posts. This is a regional style found in east-central Vermont and west-central New Hampshire, which James F. Tasker, who built a bridge on the main road at Tunbridge Village in 1873, made popular.¹

Flint Bridge, built in 1874, uses the queenpost truss instead. The same style of framing is also found in the Moxley Bridge, built in 1883 and located just upstream in Chelsea. All of the area's covered bridges cross First Branch White River in a beautiful landscape that is a rare remnant of the rural New England of a century ago. Pastures still climb high on the hillsides, occasionally to the very top. Until around 1985 there were very few twentieth-century structures other than power lines, and even today older buildings predominate.²

Early History of Flint Bridge

Most published sources on Flint Bridge say it was built in 1845, but this is in error. No covered bridges are known to have existed in Tunbridge before the 1860s.³ There were bridges, but only open ones. The main road north up the valley came along the west side of the river, generally following today's Route 110. North of the Flint Bridge turnoff is a steep hillside on the west bank. To avoid this the main road crossed the river here, where there has been a bridge since before 1804. It then entered Chelsea, followed the east riverbank until re-crossing at the Moxley Bridge, and then returned to the present route.

When Flint Bridge was built in 1874, therefore, it was on the main road. No details are known of the previous bridge, but it was on a lower level. Ira Mudgett, the builder, lived in Tunbridge and also worked on other bridges. We do not know why he used the queen post truss here, but there is evidence that he re-used some timber from the previous bridge, and if it too was a queenpost truss, the answer may simply be conservatism in design. The town records are complicated because several projects were going on at about the same time, and it is difficult to tell which expenses pertained to Flint Bridge, but the cost seems to have been around \$750.⁴ The main road was relocated

¹ James F. Tasker (1826-1903) lived in Cornish, New Hampshire, a town perhaps better known as the home of sculptor Augustus Saint-Gaudens. Several of Tasker's bridges still stand in Cornish and elsewhere.

² Some of the structures may in fact have been built in the early twentieth century, but their style was such that a traveler in Tunbridge as late as about 1970 could almost believe that the nineteenth century was still in existence.

³ Telephone conversation with Euclid Farnham, Tunbridge historian, June 7, 2002. See also his Tunbridge Past (Tunbridge, VT: Tunbridge Historical Society, 1980), p. 68.

⁴ Selectmen and Auditor's Reports of Claims in Favor and Against the Town of Tunbridge, For Year ending Feb. 17th, 1875 (commonly known as 1875 Town Report), pp. 3-4. We are indebted to Euclid

to the west riverbank in the 1890s, leaving the Flint and Moxley bridges on side roads, as we find them today.

The Queenpost Truss

The kingpost, queenpost, and multiple kingpost are known as the simple trusses, and they date back to medieval Europe. In 1570 Andrea Palladio recorded queenpost and multiple-kingpost designs, modestly stating that he had not invented them but had found them already in use.⁵ Kingpost and queenpost plans served in roof framing as well as for bridges. The simple trusses were still built well into the twentieth century, but in the late examples, steel rods often took the place of the vertical kingposts or queenposts.⁶

The basic form of the queenpost truss has two vertical members, the queenposts, held apart at the top by the upper chord, which is in compression. Each queenpost has a large brace sloping down to the end of the bridge, where it is fastened securely to the lower chord, forming a three-panel truss. Since in this design the upper chord is found only in the center panel, extra roof framing must be added if the bridge is to be fully covered. In most other truss designs, the upper chord itself can serve as part of the roof framing with the simple addition of rafters, and usually a ridgepole.

The queenpost truss was used for spans of up to about 90', and in a truss of only three panels, this leaves an excessive space between the floor supports. Typically the floor beams are atop the lower chord, but the load is distributed by dividing the truss panels into sub-panels with the addition of iron rods and extra braces. Flint Bridge shows this feature, which indeed is standard for queenpost trusses in New England.⁷

Construction Details

Flint Bridge's structure measures 87'-5". The queenposts and braces measure generally 10" x 10" although there is much manufacturing variation, even down to 9-1/2". All this timber is rotary sawn, as one could expect in a bridge built in 1874. However, the upper chord, while showing some evidence of sizing by saw, also shows traces of adze marks. In addition, the north (upstream) upper chord has a small

Farnham for his careful analysis of Tunbridge bridge history; the Town Report does not mention Flint Bridge by name.

⁵ Richard Sanders Allen, *Covered Bridges of the Northeast* (Brattleboro, VT: Stephen Green Press, 1957), pp. 10-11.

⁶ Historian Steve Roper uses terms such as "king rod" and "queen rod" to describe these trusses when metal rods are used in place of wooden posts. This terminology has the advantage of being more precise, but some object to it because the terms were not in contemporary use when such bridges were being built.

⁷ Short queenpost trusses with no or minimal sub-panel bracing were built in Pennsylvania in Columbia County and in Washington County.

unexplained, unused mortise. This may be evidence that the chord timbers were re-used from a previous bridge.⁸

The two upper lateral braces overhead, connecting the tops of the queenposts over the roadway, are rotary sawn with no evidence of hand work, like the queenposts themselves. The remainder of the upper lateral system and many of the roof framing members show obvious adze work, so they were probably also re-used. They may, of course, have been salvaged from some other structure, rather than the previous bridge.

The iron rods in the sub-panels are probably original and appear to be undersized. In 1895, engineer Jonathan Parker Snow had this to say on the sizing of members in wood trusses:

It has come within the observation of the writer many times that when an intelligent master-carpenter has had the care for a term of years of a line of wooden bridges covering any given style of truss, he gradually brings their parts, when building new ones, to almost the exact size called for by scientific analysis when actual loads are used in calculation. He will use iron rods that are too small for they show him no distress unless they break, but the timber parts guide him to right results.⁹

Though later modified, Flint Bridge's dry-laid random-course stone abutments are largely intact. The east one rests directly on a low outcrop of ledge.

Repair Record

The ends of the lower chords are a common maintenance problem in covered bridges. Often the housing does not keep out wind-blown rain. To prevent this problem, the interior of the truss is sometimes boarded over a short ways in, an arrangement called a shelter panel. Changes in road grading over the years sometimes leave covered bridges at the low point of a slope where rainwater can run in. Flint Bridge, like many others, developed rot at the chord ends, where the braces are fastened. There were some poorly planned repairs to the bridge around 1942, and by the 1960s it was in need of major work.

Milton S. Graton of Ashland, New Hampshire, one of the twentieth century's premier bridge wrights, did a very sensitive restoration in 1969.¹⁰ Under the braces near their lower ends was a short supplemental brace, which took some of the thrust off the

⁸ Field notes, June 4, 2002.

⁹ Jonathan Parker Snow, "Wooden Bridge Construction on the Boston and Maine Railroad" *Journal of the Association of Engineering Societies* (July 1895), p. 39.

¹⁰ Milton S. Graton, *The Last of the Covered Bridge Builders* (Plymouth, NH: Clifford-Nichol, 1978), pp. 15, 113-114. The A in Graton is long, and the great builder sometimes placed a macron over it to be sure it was pronounced long.

main chord joint. This was an unusual, but fortunate feature of Ira Mudgett's design: at two of the four corners, this small brace was carrying most of the load. Graton was able to keep the original lower chords by removing rotted wood under the brace end and splicing in new blocks of material. By making these blocks slightly thicker than what he was replacing, he was able to turn the bridge's 5" sag into an 8" camber.

Graton also replaced all the floor beams, and the new ones are 3-3/4" x 11-3/4" net, with slight variation in thickness. There are thirteen to fourteen per full truss panel. The old system was almost certainly similar, but with beams of smaller size, probably 3" x 10".

The plank floor is spiked to the floor beams directly, with no stringers. Its style is a Graton specialty. Many bridges have a second set of planks that act as a pair of runners on top of the deck in the area of maximum wheel wear, with awkward driving resulting if the driver goes off the runners by mistake. Instead, Graton used runners of oak that are flush with the softwood planks of the rest of the deck. They are made of three 3-1/2" x 10" planks each, while the rest of the deck uses 3-1/2" x 5-1/2" plank.

To prevent rainwater running inside, Graton raised Flint Bridge 2'; thus the original dry-laid stone abutments now have concrete caps.

The steel cable lower lateral bracing is aesthetically objectionable and was probably added at the state engineer's request. It is not the preferred Graton style of repair, and he made no mention of it in the book he wrote on his life's work. The two beams under the floor in the middle, parallel to the chords, and built up of short pieces, are also not original. They were a common addition to Vermont's covered bridges from the 1950s onwards and represent an attempt to distribute the load over a longer area.

The Future?

Since 1969, the weight of vehicles on country roads has continued to increase. The Vermont Agency of Transportation wants to build a bypass bridge here, but there are questions about the best site. If the covered bridge is closed to traffic, it will be difficult to find funds for ongoing maintenance. For now Flint Bridge still stands in daily use as a premier example of the queenpost truss, a style going back many centuries, but its future is uncertain.

Bibliography

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Tunbridge Town Meeting minutes for 1844 and 1845 (there are no published Town Reports for these early years).